DOCUMENT RESUME

ED 335 311 SP 033 158

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TITLE Higher Order Thinking "Increasing Student Interaction in the 'Thoughtful' Classroom." A Module for Staff Development.
INSTITUTION Delaware State Dept. of Public Instruction, Dover.
PUB DATE Jul 89
NOTE 68p.; For related document, see SP 033 155.
AVAILABLE FROM Delaware Bureau of Archives and Records, Hall of Records, P.O. box 1401, Dover, DE 19903 (microfiche copy).
PUB TYPE Guides - Classroom Use - Teaching Guides (For Teacher) (052)

EDRS PRICE MF01/PC03 Plus Postage.
DESCRIPTORS Elementary Secondary Education; *Interaction Process Analysis; Learning Modules; *Metacognition; School Districts; *Speech Communication; *Staff Development; State Departments of Education; *Student Participation; Teacher Effectiveness; *Teacher Workshops
IDENTIFIERS Delaware

ABSTRACT

A frequent criticism of education in the United States today is that teachers are not challenging and teaching students to think beyond the simple task of recalling information. In response to this criticism, during the school year of 1986-1987, the Delaware Department of Public Instruction and local school districts provided a staff development program in the elements of effective instruction to every teacher, specialist, and building-level administrator. The department also established a task force which recommended a state-wide development program for enhancing higher order thinking for all students, at all grade levels, and in all content areas. This training module is part of that program. Objectives stipulate that by the end of the workshop participants will be able to: distinguish between overt and covert participation; (2) identify strategies for encouraging students to assume responsibility for speaking in the classroom; (3) implement methods which promote student interaction; and (4) describe and list activities for promoting student metacognition. Materials contained in the packet are a series of handouts and transparencies related to the objectives for use in the workshop. (LL)

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HIGHER ORDER THINKING

"Increasing Student Interaction in the 'Thoughtful' Classroom"

A Module For Staff Development

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P.O. Box 1402
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July, 1989

ED335311

SP 033 158

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DOC. NO. 95-01/89/07/14

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FOREWORD

A frequent criticism of education in the United States today is that teachers are not challenging and teaching students to think beyond the simple task of recalling information. To respond to such criticism and to improve the overall effectiveness of teaching in the state, during the 1986-87 school year, the Delaware Department of Public Instruction and local school districts provided a staff development program in the elements of effective instruction to every teacher, specialist, and building-level administrator. At the same time, a performance appraisal system was being piloted (and is now implemented statewide) to reflect and support the growth of school staff members in those elements demonstrated by research to be characteristic of effective teachers.

In the Summer of 1987, the Delaware General Assembly and the Department of Public Instruction established a task force to review the nature and use of higher order thinking skills in Delaware schools. A recommendation of this task force called for the development and implementation of a state-wide staff development program for enhancing higher order thinking for all students at all grade levels in all content areas. This training module is a part of that program and of a general effort to expand the elements of effective instruction introduced statewide in 1986-87.

HIGHER ORDER THINKING

Increasing Student Interaction in the "Thoughtful" Classroom

A Module for Staff Development

Lesson/Presentation Plan

1. WARM-UP

   Handout - "Human Treasure Hunt"

   Spend 5 - 10 minutes completing and discussing the benefits. Solicit categories that could be used for students to implement in classrooms.

2. OBJECTIVES

   Transparency - "Objectives"

3. ACTIVE PARTICIPATION

   Handout - "Active Participation"
   Transparency - "Benefits of Active Participation"

   Discuss briefly - distinguish between overt and covert, emphasizing that we should not always equate physical activity with productivity.

   Finish with Transparency - "Chinese Proverb"

4. PLAY - "BECAUSE" TRANSPARENCY

   A game of creative logic. One person starts, "I don't have my homework today because (supply reason)." Next person takes that reason, adds "because" and another LOGICAL reason. Continue with whole group. Have fun!

5. THE NATURE OF CLASSROOM INTERACTION

   Research shows that teachers do too much talking.

   Bellack in Language in the Classroom looked at the nature of teacher-student interaction.

   Transparency - "Rules of Classroom Game"
   Transparency - "Typical Teacher/Pupil Interaction"

Ask, "What do you think the student's participation was like?" Get ideas.

Show Transparency - "Nature of Student Participation" Do Think-Pair-Share on how to change this. Solicit ideas - show Transparency - "Interaction Models" to illustrate some. Process Think-Pair-Share.

Refer to article, "Think-Pair-Share, a Multi-Model Discussion Technique" and show Transparency - "Cues for Listen, Think, Pair, Share"

6. PLAY - "THROW ONE OUT" TRANSPARENCY

   As a group, allowing at least 20 seconds think time before sharing. People must justify their answers. (Should get lots of groupings.)

7. DO HANDOUT - "VOCABULARY CONCEPTS

   In groups, each group doing a different line, 1 through 6. Share ideas. Process what happened during groups and sharing. (participation, interaction, expression) Ask how it could be used/ modified in classrooms.

8. REVIEW HANDOUT - "SPEECH OPPORTUNITIES"

   Ask for additional ideas where students assume speaking responsibilities.

9. METACOGNITION: PAIR PROBLEM SOLVING

   Review key points from Handout - "Mediating the Metacognitive" with Transparency - "Metacognition".

   Ask when the group has been "metacogitating" today.

   Complete Handout - "Beach Scene" as a pair problem solving activity. (Transparency - "Pair Problem Solving")

   Share results.

   Process the activity.

10. JIG SAW

    Transparency - "Jigsaw"

    Handout - "Jigsaw II"

Activity/Handout - Education and Learning to Think by Lauren Resnick

Divide participants into three (3) groups. Assign each group a reading from Education and Learning to Think:

Group 1 - "Thinking In The Curriculum"
"Embedding Thinking Skills in Academic Disciplines"
Group 2 - "Higher Order Approaches To The Enabling Disciplines"
Group 3 - "Cultivating the Disposition To Higher Order Thinking"

The task of each group is to complete the reading, write down and discuss the main ideas, and become "experts" with the information so they can teach it to others.

Then, divide participants into groups of three (3) with each group composed one member from each of the three previous groups. Each group member teaches the other group members the information from his/her particular reading. (This way, in cooperative groups, each participant is taught all of the information in a relatively short period of time.)

11. BRAINSTORMING FOR IDEA GENERATION

Transparency/Handout - "Brainstorming"

Emphasize that brainstorming is for idea generation, so everyone needs to feel comfortable. All ideas are welcomed, non-judgmentally - what you do when you foster thinking. Review rules.

Do a "fun" activity, like "How else can we use those plastic bags we get at the grocery store?"

Check to see if people were:

Fluent - lots of ideas.
Flexible - lots of different ideas. (i.e. different use categories)
Elaborative - did you change bags in any way?
Original - which ideas were like none other in room?

12. SUMMARY: FORCED ASSOCIATION

Summarize with a forced association activity. Each person should complete the sentence, "Thinking is like candy because. . ." (Transparency)

Do think-pair-share: record all ideas.

13. CONCLUSION

Review objectives (transparency) or have participants come up with statements that summarize the workshop.

HANDOUTS

HUMAN TREASURE HUNT

Your mission is to find someone in the group who meets a description below. You should attempt to talk with everyone in the group in your search. A person may sign no more than two descriptions.

Good luck Sherlock!

FIND SOMEONE WHO:

1. is the closest to retirement _____
2. jogs, works out, swims or otherwise engages in regular stimulating physical activity _____
3. is involved in a post-graduate program at present _____
4. manages or coaches a Little League team _____
5. has received an excellence in education award/ honor _____
6. bowls in an established league _____
7. speaks a foreign language _____
8. has the shortest traveling time to get to work _____
9. reads at least one new book a week _____
10. has traveled the farthest this summer _____
11. maintains a collection of some sort _____
12. enjoys water sports and participates regularly _____
13. will change his/her name or residence within the next year _____
14. has read, or could have written, The Acquitaine Progression, The Joy of Sex, or Megatrends. _____

PD:bj
6/89

DATA/INPUT

I. DEFINITION: ACTIVE PARTICIPATION IS THE CONSISTENT INVOLVEMENT OF THE LEARNER'S MIND WITH THAT WHICH IS TO BE LEARNED.

A) CONSISTENT INVOLVEMENT = CONSTANT ENGAGEMENT OF STUDENT'S BRAIN THROUGHOUT THE INSTRUCTION.

B) THAT WHICH IS TO BE LEARNED = THE CONTENT OF THE LESSON.

II. TWO FORMS OF ACTIVE PARTICIPATION:

A) OVERT:

1) ANY OBSERVABLE FORM OF INVOLVEMENT SUCH AS WRITE, TELL, DEMONSTRATE, AND RAISE HAND.

2) ALLOWS THE TEACHER TO MONITOR STUDENT INVOLVEMENT BUT MAY BE VERY TIME CONSUMING.

B) COVERT:

1) ANY UNOBSERVABLE FORM OF INVOLVEMENT SUCH AS THINK ABOUT, IMAGINE, RECALL AND REVIEW IN YOUR MIND.

2) DOES NOT ALLOW TEACHER TO KNOW IF STUDENTS ACTUALLY ARE INVOLVED, BUT IS AN EFFICIENT USE OF CLASSROOM TIME.

III. IMPORTANT CONSIDERATIONS:

A) WHEN BALANCED WITH OVERT ACTIVE PARTICIPATION, THE PROBABILITY THAT STUDENTS ARE COVERTLY INVOLVED INCREASES.

B) NEITHER OVERT NOR COVERT ACTIVE PARTICIPATION IS SUPERIOR TO THE OTHER.

III. IMPORTANT CONSIDERATIONS: (CONTINUED)

C. ACTIVITY SHOULD BE RELEVANT TO YOUR OBJECTIVE.
ACTIVITY FOR ACTIVITY'S SAKE IS NOT ALWAYS EFFECTIVE.

IV. EXAMPLES OF COVERT ACTIVE PARTICIPATION:

- "THINK ABOUT THE COLOR RED AND SOME THINGS THAT ARE THAT COLOR.
- "LOOK FOR EXAMPLES OF USING A COMMA TO SEPARATE ITEMS IN A LIST."
- "VISUALIZE EXAMPLES OF CONIFEROUS TREES."

EXAMPLES OF OVERT ACTIVE PARTICIPATION:

- "I'LL READ THE ANSWERS, YOU CIRCLE THE ONES YOU HAVE CORRECT."
- "IF THE STATEMENT IS FACT, LOOK AT ME; IF FICTION, LOOK AT YOUR DESK."
- "BRAINSTORM IDEAS FOR PLACES TO BORROW MONEY FOR A CAR."

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Example:

Covert:

1. Visualize how the pistons in a car engine work.
2. Compute in your head the answer to 5 x 50.
3. Pretend you're a character in a book. How would you feel and what would you do?
4. Remember a holiday that stands out in your mind.
5. Picture yourself using the proper technique for a correct golf swing.
6. Think about all the things you have that are assets; that are liabilities.
7. Look for errors in capitalization in the sentences that are on the board.
8. Think about all the ways you could use burlap to decorate.
9. Follow along while the teacher reads the instructions.
10. Watch the technique I use in executing this dance step.
11. Say to yourself the 5 levels of the deciduous forest.
12. Suppose you're in a boat out on the lake and the only pair of oars you have falls overboard.
13. Create mental pictures of the donkeys walking along the Grand Canyon in the Grand Canyon Suite.
14. Close your eyes and smell a freshly-mowed lawn.
15. Guess what I have in this paper bag.

Overt:

1. Watch what I do and repeat it back to me.
2. Students show a flashcard with "s" on one side and "es" on the other to show the correct plural ending of a word given by the teacher.
3. Use a chaining activity where one student says Sunday, the next Monday, etc. as indicated by the teacher. (Be sure to call on students randomly)
4. Use role playing to simulate an event either individually or in small groups (Small group reduces risk factor).
5. Thumbs up, thumbs down, or out to side to indicate yes, no, and I don't know.
6. Discuss with your neighbor before I call on someone to answer.
7. While some students respond at the chalkboard, others are writing answers on paper at seats.
8. Point to the half notes in this piece of music.
9. Complete a worksheet.
10. Teach or help someone else with a particular classroom assignment.
11. "Everyone get up and find something in the classroom that's red (wood, glass, plastic, etc.)."
12. Have students recite answers either as a group or individually (chosen randomly).
13. Using your finger in the air, write the answer to 7 + 5.
14. "Take the following dictation."
15. Compute the answer and check it on the calculator.

Active Participation is the consistent engagement of the learners' minds with what is to be learned. Listed below are teacher behaviors that will elicit active participation from students.

OVERT (observable)	COVERT (non-observable)
Watch what I do and repeat it back to me.	Visualize....
In reading group, I say a word. They listen for a beginning sound. When they hear it, they wink.	Look for errors on board (teacher errors).
"Everyone get up and find something in the room that's red!"	Compute in your head.
Call on student after you've asked the question.	Watch, think, listen, smell (use senses)
"I'll read the answers, you circle the ones you have correct."	Pretend you're a character in a book. How would you feel and what would you do?
"If it is a fact, clap your hands. If it's fiction, stomp your foot."	Follow along while the teacher reads.
Reading out loud--choral reading	Put yourself in _____'s place.
Follow the leader.	Remember when.....
Teach someone else.	Be ready to explain.....
Underline.....	Look for examples of.....
Point to.....	Think of terminology related to activity.
Take notes while the speaker is talking. List all the major points stated by the speaker.	Guess.....
Discuss in small groups the topic given to you.	Say to yourself/ask yourself.....
Write down your reaction.	Create mental pictures.
Brainstorm in group.	Suppose.....
Explain the steps to your partner.	Think about the color red and how many things have that color.
Put your hand on your head if you disagree.	Flash color cards and have students think of a mood.
Complete a worksheet.	Think back to what you saw on our field trip/to yesterday's lesson.
	Think about what you would like to do for this project.

Abuses of Active Participation

1. Using respondent's name before asking the question.

   (Jim, name the capital of Minnesota.")

2. Using a patterned student selection

   (e.g. going up and down the rows for answers)

3. Prompting the better student, not prompting poor student with answer.

4. Inappropriate wait time (research shows average wait time is about a second).

5. Calling only on volunteers.

6. Calling on same students all the time.

7. Lack of variety of participation techniques used.

8. Active responses which are irrelevant to the purpose of the lesson.

THINK-PAIR-SHARE: A MULTI-MODE DISCUSSION TECHNIQUE

A teacher stops the group discussion again to remind the children not to talk out. When the discussion resumes, one child gives a lengthy, yet practically inaudible response to the teacher's question. The children on the edges of the group begin again to talk and shift around. The teacher gives them the "look" and hears very little of what the one child is saying. She tries to change pace by asking an inference question. No one cares to respond. The teacher rephrases, then answers the question.

This frustrating scene and others like it are familiar to anyone who has taught. When asked what were the inherent problems of running classroom discussions in the traditional way, some elementary and middle school classroom teachers in Maryland responded with the following phrases: "not listening," "same kids always talk," "distractions," "day dreaming," "feeling left out," "fear-anxiety," "teacher burnout," "enthusiasm (has to be) contained," "teacher dominated," "teachers do not listen," "lack of focus," "reinforces personality sets - quiet kids always stay that way," "too much demand on attention span," "no student interaction," "not enough wait-time," "develops competition." Similar indictments of the one-speaker-at-a-time discussion technique would be brought forth by any group of teachers or even students. A strategic solution to these and other problems related to having one student talk at a time can be found in "Think-Pair-Share" - a multi-mode, discussion cycle response technique now in use in many Howard County and other Maryland elementary and middle school classrooms, and being presented in courses by faculty in the College of Education at the University of Maryland, Towson State University, and Coppin State University.

Think-Pair-Share

Suppose the rules were changed. A teacher is sitting with a third grade reading group. She asks how the character in the basal reader story is similar to Dorothy in The Wizard of Oz. While she talks, she is holding a 6" x 6" x 6"

cube (mode changer) with the surface saying LISTEN pointed toward the group. When the question is asked she turns the cube to the THINK cue on the next side. No one talks. After 10 seconds the cube is turned again to PAIR and children respond to the question with a partner. The teacher listens and when it is obvious that the students have come up with some answers, a transition cue (a noise or a gesture) informs the pairs that they have 10 seconds to finish talking and to get ready to SHARE, which is the next cue on the cube. In the SHARE mode, the children raise their hands and some are called upon to speak.

This sequence would be typical of a discussion in which the teacher and students cycle through four response modes - LISTEN, THINK, PAIR, SHARE: hence, the term multi-mode teaching. Discussion/lecture teaching in all subjects, at all grade levels with all size groups, and with all ability levels could be conducted in this three-four mode cycle, rather than in two modes (LISTEN-SHARE) as is traditionally the case with the recitation model. Whereas the PAIR would not be used for every question, students always have a THINK mode and the teacher makes the decision each time whether to go to PAIR or directly to SHARE. To get a picture of the possibilities inherent in this multi-mode cyclying, the teacher needs to know more about the necessary elements, the first of which is the mode changer.

Mode Changers

A key ingredient for classroom management is congruence of expectations between teacher and students. A mode changer such as the cube mentioned above is designed to provide a mutual understanding about what is to be happening at each phase of the discussion cycle. For instance, without some such device and a transition cue, bringing the children out of the PAIR mode is a fuzzy proposition, requiring tiresome verbalizing of the teacher. Mode changers may be wheels, hexagonals, small and large cubes, large wall charts, magnetic arrows on the blackboard, musical tones, electronic flashings, hand-held charts, hand gestures, verbal signals, or color-coded symbols. In fact, any tool may be used which is

appropriate for the size of the group, the level of the students, or the topic being discussed. A teacher and class committed to the technique might employ three or four such devices. Recent experience has shown a series of hand signals to be effective, with the advantage that hands are permanently attached mode changers.

Intra-Modes

Pair talk skills need to be learned and structured. One individual can dominate another in pair talk. There are also other undesirable outcomes of this cooperative response mode which can be minimized by structuring the pair talk in various "intra" ways. For example, pairs can do active listening (child repeats what the other says) after which each student has to share the partner's response with the class. This active listening intra-mode could be taught, labeled "partner-share," and written on a wall cue card for reference. Another structure is "agree" in which pairs try to reach consensus. To decrease the incidence of dominance, pairs can do "switch off" in which partners alternate as to who speaks first in the pair mode. "Spin off" or "teacher" is a fourth intra-mode in which the pairs create and answer a question of their own, or perhaps reshape the teacher's question. They are then sometimes asked to manipulate the mode changer themselves, using their own questions and being "teachers" for the rest of the group. There are obviously other possibilities. These pair-mode structurings, labeled, and wall-cued, are then available for use in the multi-mode discussion.

Pair Selecting

Particularly for the improvement of interpersonal relationships among students, there should be several pre-arranged pairings for large and small groups. These teacher-designed, sometimes student-selected pairings could be given names or colors and the lists placed on the walls for reference. The selections might be governed by different considerations, some of which are: degree of outgoingness, personal relationship, learning styles characteristics. Older students might even be paired according to similarity or difference in tolerance for ambiguity. In

multicultural settings, integrating the pairs ethnically is desirable. Of course, on some occasions, a brave teacher might let the students choose a partner on the spot.

Deadlines and Transition Cues

People seem to stay on task better when faced by a deadline. Whereas it is not always necessary, a time limit for questions seems to give the pairs a sense of urgency which contributes to task orientation.

The only transition cue necessary for multi-mode discussion is the sound or gesture signaling a number of seconds to finish up talking in pairs. With a large group of 25 or more a second sound cue indicates the start of the SHARE mode.

Applications

After a field trip, a second grade teacher gathers the class together for discussion. (The mode changer is a 3' x 4' chart with a pulling arrow.) He asks the children to sit in "blue" pairs, which is the friends pairing. They are told they will be doing "partner share" and "switch off," the active listening and speaker-alternating intra-modes. He asks recall and analogy questions. The children are given a time limit for each response in pairs and each SHARE mode lasts about two minutes as four or five students respond. While the children talk in pairs, the teacher walks among them and listens.

A seventh grade teacher has shown a filmstrip. The 90 students are being asked cause/effect and analogy questions related to the film's content. They are in pre-designated extravert/introvert pairs and appropriately are in the "switch off" intra-mode. The teacher uses a double bell cue for the PAIR to SHARE transition. The SHARE mode phases are only 30-60 seconds long. The mode changer is a wooden wheel on a stand.

A high school English seminar is focused on Animal Farm. Seventeen students are paired to respond to questions regarding the story's possible representational meanings. The students are paired according to where they are sitting and they are in a "spin-off" intra-mode in which they make up their own question after

answering that of the teacher. No transition bell is necessary since everyone is seated in a small circle. The mode changer is a covered box mounted on a lazy susan turntable. SHARE mode phases last from three to four minutes. At intervals, the teacher lets a student run the seminar in multi-mode using the created questions.

Evidence of Value

Rather than cite research findings on THINK-PAIR-SHARE (there have been several action research studies by student teachers and teachers), or to list the advantages of the technique, it seems more challenging to pose some questions for the classroom teacher. For instance, what would the difference in the effects be between multi-mode and one-at-a-time discussion in:

1. Students' short and long-term recall of information;
2. Students' willingness to speak in the SHARE mode;
3. Students' willingness to listen in the SHARE mode;
4. Students attending behavior overall (degree of disruptive behavior);
5. Classroom interpersonal relationships;
6. The amountof participation of the students with "learning disabilities;"
7. Student satisfaction with discussion;
8. The kinds of questions asked by teachers;
9. Teacher energy expended;
10. Teacher "wait time" after a question;
11. Teacher knowledge about students' knowledge.

These are questions teachers can answer for themselves rather than waiting for outside authority to do the inquiry.

A Classroom for Response

The multi-mode discussion technique is part of a vision of classroom teaching which includes several other modes and kinds of cues - in essence, a classroom of systematized student response. To exemplify the larger picture imagine this scene: Each fourth grade student has a set of 3" x 5" cards on a ring. The

teacher asks a question or allows the students to create a question at different levels from a set of thinking cues. In the multi-mode cycle, students diagram (the LINK mode)* their answer on a card, choosing their diagram shape from a set wall-cued models. At the end of the class, the students hand up their "thinking map" ring on a hook. The THINK and PAIR modes have been combined with a LINK mode.

Promise

The THINK-PAIR-SHARE technique can revolutionize classroom discussion, nursery through graduate school. Put together with other response modes, as well as wall-cues which make types of thinking, multiple contexts, and concepts accessible to the students, a different kind of classroom dynamics emerges - one in which all students are invited to think productively.

*Related to a strategy called "THINK LINKS," or cognitive mapping, a graphics learning mode developed by classroom teachers in Howard County and throughout Maryland. The strategy is promoted and researched by the University of Maryland Reading Center at College Park, and was brought to Maryland in 1968 by Frank Lyman

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PROCEDURE FOR USING THE QUESTION/RESPONSE CUES

1. Construct and laminate the type symbol cards (8" X 10") and place them in full view on the walls, bulletin boards, or chalkboards. You may want to magnetize the cards if you have appropriate walls or boards.

2. Begin using the symbols to derive your questions as you are discussing a topic with a group.

3. Gradually let the students in on the secret of your questioning. It is probably best to begin with "R" since students can easily understand that "R" represents "recall."

4. Teach the students how to use some or all of the symbols to make up questions. This encourages metacognition (knowing how you know).

5. Encourage students to categorize questions and responses according to type.

6. Create a grid, or Think Trix*, which you and your students may use as an oral, diagrammatic, and written question and/or response generator.

7. Construct and laminate Think Link, webbing, or mindmap shapes which students may use as prototypes to generate and organize thinking. Again, you might want to magnetize these shapes.

8. Use the Think Trix in conjunction with the Think Link shapes to facilitate diagrammatic responses. These responses may stand by themselves or be "bludprints" for written or oral composition.

Question type cues have been used effectively by teachers and student teachers in Howard County, MD, as well as in other school systems. When used in conjunction with Think-Pair- Share (wait time and pair learning), Think Links (concept mapping), lists of learning strategies, problematic situations (weird facts or problems), and lists of contexts (common frames of reference), these cued thinking process symbols create a classroom system for learning how to think.

Contact Frank Lyman (Howard County Schools/ University of Maryland) for information on the use of thinking cues. Some of the Howard County teachers who actively use the process at the time of this publication (June 1986) are Becky McArthur, Sam Pollack, Jim Pope, Belinda Rosenberger, Carla Beachy, Nancy Koza, Francis Baranson, Arlene Mindus, Sharon Giorgio, Mychael Willon, and Bob Gottemeyer.

By Frank Lyman
*The name *Think Trix* was invented by Tom Payne.
Published by the Howard County Public Schools Staff Development Center
1986

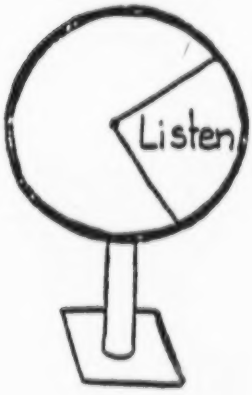
Hand Signals

Listen Think Pair Share

Cube

Cues for Listen · Think · Pair · Share

Wheel



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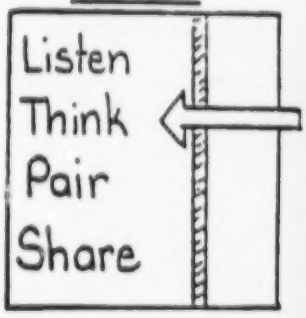
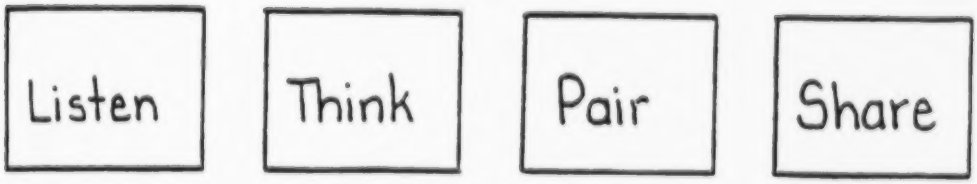


Cards



VOCABULARY CONCEPTS

Directions: Six rows of words are listed below, with five words or terms given in each row. You are to cross out one word in each row and be prepared to tell how the other four relate to one another. The relationships differ; the example that is given shows only one type of relationship.

Example: captain ruler kingdom team group

A captain runs a team; a ruler runs a kingdom.

1.	hemisphere	continent	country	county	state
2.	business	employer	product	manufacture	employee
3.	law	ordinance	legislate	prosecution	judicial
4.	campaign	candidate	ballot	bipartisan	caucus
5.	slavery	abolition	freedom	integration	equality
6.	union	arbitration	employer	employee	strike

MD:bj
07/89

SPEECH OPPORTUNITIES

Oral communication, like reading and writing, cuts across disciplinary lines and plays a significant role in every classroom situation.

The classroom environment should nurture thoughtful oral communication and provide structured speech opportunities.

- Require that everyone speak in complete sentences.
- Encourage students to work together in groups.
- Use games and simulations to teach.
- Ask students to share their written work and their ideas in oral reports, debates, panel discussions, symposia, etc.
- Let students develop their own questions about reading, oral reports, etc.
- Utilize "think-pair-share." Allow two minutes of individual think time, two minutes discussion with a partner, then open up the class discussion.
- Talk through personal and procedural differences of opinion.
- Ask students to paraphrase another's response or question.
- Ask students to "unpack their thinking" about how they arrived at their answer.
- Ask students to summarize the major points of a group discussion.
- Provide opportunities for students to teach, tutor, or otherwise aid in the instructional process.
- Have children give directions for work to be done in class or special projects.
- Have student introduce guests in the classroom where appropriate.
- Complete personal sentence starters or give two-minute impromptu speeches. Children can contribute to file of sentence starters or topics.
- Read aloud various types of poetry, observing poetic expression.
- Give commentaries for silent movies, filmstrips, or slide shows.
- Use tape recorders for speeches and reports. Record individually. Interested members of the class can listen individually.
- Tell a story through a sequence of pictures, pantomine, dance, tableaus, dramatization, choral speech.
- Never humiliate or ridicule students who share their ideas in class or permit others to do so.
- Especially, do not view outspokeness as an irritant in the classroom. Watch for clues that say that you should allow more time to talk.

MD/dal
5/89

Try to solve this problem in your head:

How much is one half of two plus two?

Did you hear yourself talking to yourself? Did you find yourself having to decide if you should take one half of the first two (which would give the answer, three) or if you should sum the two's first (which would give the answer, two)?

If you caught yourself having an "inner" dialogue inside your brain, and if you had to stop to evaluate your own decision making/problem-solving processes, your were experiencing META-COGNITION.

Occurring in the neo-cortex and therefore thought by some neurologists to be uniquely human, meta-cognition is our ability to know what we know and what we don't know. It is our ability to plan a strategy for producing what information is needed, to be conscious of our own steps and strategies during the act of problem solving, and to reflect on and evaluate the productiveness of our own thinking. While "inner language", thought to be a prerequisite, begins in most children around age five, meta-cognition is a key attribute of formal thought flowering about age eleven. Interestingly, not all humans achieve the level of formal operations (Chiabetta, 1976). And as Alexander Luria, the Russian psychologist found, not all adults meta-cogitate (Whimbey, 1976).

"THE TROUBLE WITH MARGARET IS, THAT WHEN SHE KNOWS, SHE *KNOWS* SHE KNOWS!"

We often find students following instructions or performing tasks without wondering why they are doing what they are doing. They seldom question themselves about their own learning strategies or evaluate the efficiency of their own performance. Some children virtually have no idea of what they should do when they confront a problem and are often unable to explain their strategies of decision making. (Sternberg and Wagner, 1982) There is much evidence, however, to demonstrate that those who perform well on complex cognitive tasks, who are flexible and perserverent in problem solving, who conciously apply their intellectual skills, are those who possess well developed meta-cognitive abilities (Bloom, & Broder, 1950), (Brown, 1978), (Whimbey, 1980). They are those who "manage" their

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intellectual resources well: 1) their basic perceptual-motor skills; 2) their language, beliefs, knowledge of content, and memory processes; and 3) their purposeful and voluntary strategies intended to achieve a desired outcome (Aspen Institute, 1982).

If we wish to install intelligent behavior as a significant outcome of education, then instructional strategies, purposefully intended to develop childrens' meta-cognitive abilities, must be infused into our teaching methods, staff development, and supervisory processes (Costa, 1981). Interestingly, DIRECT instruction in meta-cognition may NOT be beneficial. When strategies of problem solving are imposed by the teacher rather than generated by the students themselves, their performance may become impaired. Conversely, when students experience the need for problem solving strategies, induce their own, discuss and practice them to the degree that they become spontaneous and unconsious, their meta-cognition seems to improve (Sternberg and Wagner, 1982). The trick, therefore, is to teach meta-cognitive skills without creating an even greater burden on their ability to attend to the task.

Problably the major componants of meta-cognition are developing a plan of action, maintaining that plan in mind over a period of time, then reflecting back on and evaluating the plan upon its completion. Planning a strategy before embarking on a course of action assists us in keeping track of the steps in the sequence of planned behavior at the conscious awareness level for the duration of the activity. It facilitates making temporal and comparative judgments, assessing the readiness for more or different activities, and monitoring our interpretations, perceptions, decisions and behaviors. An example of this would be what superior teachers do daily: developing a teaching strategy for a lesson, keeping that strategy in mind throughout the instruction, then reflecting back upon the strategy to evaluate it's effectiveness in producing the desired student outcomes.

Rigney, (1980) identified the following self-monitoring skills as necessary for successful performance on intellectual tasks:

Keeping one's place in a long sequence of operations,

Knowing that a subgoal has been obtained, and

Detecting errors and recovering from those errors either by making a quick fix or by retreating to the last known correct operation.

Such monitoring involves both "looking ahead" and "looking back". Looking ahead includes:

Learning the structure of a sequence of operations,

Identifying areas where errors are likely,

Choosing a strategy that will reduce the possibility of error and will provide easy recovery,

Identifying the kinds of feedback that will be available at various points, and evaluating the usefulness of that feedback.

Looking back includes:

Detecting errors previously made,

Keeping a history of what has been done to the present and thereby what should come next, and

Assessing the reasonableness of the present immediate outcome of task performance.

A simple example of this might be drawn from a reading task. It is a common experience while reading a passage to have our mind "wander" from the pages. We "see" the words but no meaning is being produced. Suddenly we realize that we are not concentrating and that we've lost contact with the meaning of the text. We "recover" by returning to the passage to find our place, matching it with the last thought we can remember, and once having found it, we read on with connectedness. This inner awareness and the strategy of recovery are componants of meta-cognition.

STRATEGIES FOR ENHANCING META-COGNITION *

Following are a dozen suggestions that teachers of any grade level can use to enhance meta-cognition. Whether teaching vocational education, physical education, algebra, or reading skills, teachers can promote meta-cognition by using these and similar instructional techniques.

1. STRATEGY PLANNING.

PRIOR to any learning activity, teachers will want to take time to develop and discuss strategies and steps for attacking problems, rules to remember, and directions to be followed. Time constraints, purposes, and groundrules under which students must operate should be developed and "interiorized". Thus, students can better keep these in mind during and evaluate their performance after the experience.

DURING the activity, teachers can invite students to share their progress, thought processes, and perceptions of their own behavior. Asking students to indicate where they are in their strategy, to describe the "trail" of thinking up to that point, and what alternative pathways they intend to pursue next in the solution of their problem, helps them become aware of their own behavior. (It also provides the teacher with a diagnostic "cognitive map" of the student's thinking which can be used to give more individualized assistance.)

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* For several of these techniques I am deeply indebted to Fred Newton, Multnomah County, (Oregon) Superintendent of Schools Office; Juanita Sagan, a therapist in Oakland, California; and Ron Brandt of A. S. C. D.

Then, AFTER the learning activity is completed, teachers can invite

students to evaluate how well those rules were obeyed, how productive were the strategies, whether the instructions were followed correctly, and what would be some alternative more efficient strategies to be used in the future.

I know a Kindergarten teacher who begins and ends each day with a class meeting. During these times, children make plans for the day. They decide upon what learning tasks to accomplish and how to accomplish them. They allocate classroom space, assign roles, and develop criteria for appropriate conduct. Throughout the day the teacher calls attention to the plans and groundrules made that morning and invites students to compare what they are doing with what was agreed. Then, before dismissal, another class meeting is held to reflect on, evaluate, and plan further strategies and criteria.

2. QUESTION GENERATING.

Regardless of the subject area, it is useful for students to pose study questions for themselves prior to and during their reading of textual material. This self-generation of questions facilitates comprehension. It encourages the student to pause frequently and perform a "self-check" for understanding, to detgermine whether or not comprehension has occurred. If, for example: they know the main characters or events; they are grasping the concept; if it "makes sense", if they can relate it to what they already know, if they can give other examples or instances, if they can use the main idea to explain other ideas; or if they can use the information in the passage to predict what may come next. They then must decide what strategic action should be taken to remove obstacles to and thereby increase comprehension. This helps students become more self-aware and to take conscious control of their own studying. (Sanacore, 1984)

3. CONSCIOUS CHOOSING.

Teachers can promote meta-cognition by helping students explore the consequences of their choices and decisions prior to and during the act of deciding. Students will then be able to perceive causal relationships between their choice, their actions, and the results they achieved. Providing non-judgmental feedback about the effects of their behaviors and decisions on others and on their environment helps students become aware of their own behaviors. For example, a teacher's statement, "I want you to know that the noise you're making with your pencil is disturbing me," will better contribute to meta-cognitive development than the command, "John, stop tapping your pencil!"

4. DIFFERENTIATED EVALUATING.

Teachers can enhance meta-cognition by causing students to reflect upon and categorize their actions according to two or more sets of evaluative criteria. An example would be inviting students to distinguish what was done that day that was was helpful and hindring; what

they liked and didn't like; or what were plusses and minuses of the activity. Thus, students must keep the criteria in mind, apply them to multiple classification systems, and justify their reasons accordingly.

5. TAKING CREDIT.

Teachers may cause students to identify what they have done well and invite them to seek feedback from their peers. The teacher might ask, "What have you done that you're proud of?" "How would you like to be recognized for doing that?" (Name on the board, hug, pat on the back, handshake, applause from the group, etc.) Thus students will become more conscious of their own behavior and apply a set of internal criteria for that behavior which they consider "good".

6. OUTLAWING "I CAN'T".

Teachers can inform students that their excuses of "I can't," "I don't know how to....", or "I'm too slow to....." are unacceptable behaviors in the classroom. Rather, having students identify what information is required, what materials are needed, or what skills are lacking in their ability to perform the desired behavior is an alternative and acceptable response. This helps students identify the boundaries between what they know and what they need to know. It develops a perserverent attitude and enhances the student's ability to create strategies that will produce needed data.

7. PARAPHRASING OR REFLECTING BACK STUDENTS' IDEAS.

Paraphrasing, building upon, extending, and using students' ideas can make them consious of their own thinking. Some examples might be by saying: "What your telling me is...," or "What I hear in your plan are the following steps...," or "Let's work with Peter's strategy for a moment."

Inviting students to restate, translate, compare, and paraphrase each other's ideas causes them to become not only better listeners of other's thinking, but better listeners to their own thinking as well.

8. LABELING STUDENTS' BEHAVIORS.

When the teacher places labels on students' cognitive processes, it can make them conscious of their own actions: "What I see you doing is making out a plan of action for..." "What you are doing is called an experiment." "You're being very helpful to Mark by sharing your paints. That's an example of cooperation."

9. CLARIFYING STUDENTS' TERMINOLOGY.

Students often use "hollow," vague, and non-specific terminology. For example, in making value judgments students might be heard saying, "It's not fair....", He's too strict..." "It's no good...". Teachers need to get in the habit of clarifying these values: "What's TOO strict?" "What would be more fair?"

We sometimes hear students using nominalizations: "They're mean to

me..." "Who are they?" "We had to do that...." "Who is we?" "Everybody has one...." "Who is ev body?" Thus, clarifying causes students to operationally define their terminology and to examine the premise on which their thinking is based. It is desirable that, as a result of such clarifying, students would become more specific and qualifying in their terminology.

For older children, above age eleven or so, it appears helpful to invite them to clarify their problem solving processes. Causing them to describe their thinking while they are thinking seems to beget more thinking. Some examples might be: inviting a student to talk aloud as he or she is solving a problem; discussing what is going on in their head, for example, when they confront an unfamiliar word while reading; or what steps they are going through in deciding whether to some article at the store.

After solving a problem, the teacher can invite a clarification of the processes used: "Sarah, you figured out that the answer was 44; Shawn says the answer is 33. Let's hear how you came up with 44; retrace your steps for us." Thus clarifying helps students to re-examine their own problem-solving processes, to identify their own errors and to self-correct. The teacher might ask a question such as: "How much is three plus four?" The student may reply, "12". Rather than merely correcting the student, the teacher may choose to clarify: "Gina, how did you arrive at that answer?" "Well, I multiplied four and three and got.....Oh, I see, I multiplied instead of added."

10. ROLE PLAYING AND SIMULATIONS.

Having students assume the roles of other persons causes them to consiously maintain in their head the attributes and characteristcs of that person. Dramatization serves as an hypothesis or prediction of how that person would react in a certain situation. This also contributes to the reduction of ego-centered perceptions.

11. JOURNAL KEEPING.

Writing and illustrating a personal log or a diary throughout an experience over a period of time causes the student to synthesize thoughts and actions and to translate them into symbolic form. The record also provides an opportunity to revisit initial perceptions, to compare the changes in those perceptions with the addition of more data, to chart the processes of strategic thinking and decision making, to identify the blind alleys and pathways taken, and to recall the successes and the "tragedies" of experimentation. (A variation on writing journals would be making video and/or audio tape recordings of actions and performances over time.)

12. MODELING.

Of all the instructional technqiues suggested, the one with the probablity of greatest influence on students is that of teacher modeling. Since students learn best by imitating the significant adults around them, the teacher who publicly demonstrates meta-cognition will probably produce students who meta-cogitate. Some indicators of teacher's public meta-cognitive behavior might be: Sharing their planning—describing their

goals and objectives and giving reasons for their actions; making human errors but then being seen to recover from those errors by getting "back on track"; admitting they do not know an answer but designing ways to produce an answer; seeking feedback and evaluation of their actions from others; having a clearly stated value system and making decisions consistent with that value system; being able to self-disclose—using adjectives that describe their own strengths and weaknesses; demonstrating understanding and empathy by listening to and accurately describing the ideas and feelings of others.

EVALUATING GROWTH IN META-COGNITIVE ABILITIES

We can determine if students are becoming more aware of their own thinking as they are able to describe what goes on in their head when they are thinking. When asked, they can list the steps and tell where they are in the sequence of a problem solving strategy. They can trace the pathways and dead-ends they took on the road to a problem solution. They can describe what data are lacking and their plans for producing those data.

We should see students becoming more perserverant when the solution to a problem is not immediately apparent. This means that they have systematic methods of analyzing a problem, knowing ways to begin, knowing what steps must be performed and when they are accurate or are in error. We should see students taking more pride in their efforts; becoming self-correcting, striving for craftsmanship and accuracy in their products, and becoming more autonomous in their problem solving abilities.

Teaching for thinking is becoming the great educational emphasis for the 80's. Meta-cognition is an attribute of the "educated intellect". It must be included if thinking is to become a durable reality for the 90's and beyond.

by Dr. Arthur L. Costa

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Beach Scene

Five friends biked to the beach one Saturday afternoon. Each one took a different route. Read the clues below. Then, on the grid at the bottom of the page, place an "X" to match each biker with the correct sequence of his or her arrival.

Clues

1. Everyone arrived at ten-minute intervals.
2. Howard was the first to arrive.
3. Anna arrived twenty minutes after Veronica.
4. Howard and Steve were playing volleyball when Danny arrived.
5. Danny arrived ten minutes after Anna.
6. Veronica went swimming before Steve arrived with the towels.

	1st	2nd	3rd	4th	5th
Howard					
Anna					
Steve					
Danny					
Veronica					

Name _____

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JIGSAW II

Overview

Jigsaw II can be used whenever the material to be studied is in written narrative form. It is most appropriate in such subjects as social studies, literature, some parts of science, and related areas in which concepts rather than skills are the learning goals. The instructional "raw material" for Jigsaw II should usually be a chapter, story, biography, or similar narrative or descriptive material.

In Jigsaw II, students work in heterogeneous teams as in STAD and TGT. The students are assigned chapters or other units to read, and are given "Expert Sheets" which contain different topics for each team member to focus on when reading. When everyone has finished reading, students from different teams with the same topic meet in an "expert group" to discuss their topic for about 30 minutes. The experts then return to their teams and take turns teaching their teammates about their topics. Finally, students take quizzes that cover all the topics, and the quiz scores become team scores as in STAD. Also as in STAD, the scores that students contribute to their teams are based on the individual improvement score system, and students on high-scoring teams may receive certificates or be recognized in a newsletter or bulletin board. Thus, students are motivated to study the material well and to work hard in their expert groups so that they can help their team do well. The key to Jigsaw is interdependence—every student depends on his or her teammates to provide the information he or she needs to do well on the quizzes.

Preparing to Use Jigsaw II

Materials. Before beginning, make an Expert Sheet and a quiz for each unit of material. At present, Johns Hopkins Team Learning Project materials are available for Jigsaw only in junior high school U.S. History, but preparing these materials is not difficult. An example of a complete Jigsaw II unit appears in Appendix 10.

To make materials for Jigsaw II follow these steps:

1. Select several chapters, stories, or other units, each covering material for a two- to three-day unit. If students are to read in class, the selections should not require more than a half hour to complete; if the reading is to be assigned for homework, the selections can be longer.

2. Make an Expert Sheet for each unit. This tells students what to concentrate on while they read, and which expert group they will work with. It identifies four topics that are central to the unit. For example, an Expert Sheet for the Level Four Harcourt Brace Jovanovich social studies book might refer to a section on the Blackfoot Indian tribes that is used to illustrate a number of concepts about groups, group norms, and leadership. The Expert Sheet for that section might be as follows:

Expert Sheet

"The Blackfoot"

To read: Pages 3-9 and 11-12.
Topics:

1. How were Blackfoot men expected to act?
2. What is a group and what does it do? What are the most important groups for the Blackfoot?
3. What did Blackfoot bands and clubs do?
4. What were the Blackfoot customs and traditions?

As much as possible, the topics should cover themes that appear throughout the chapter, instead of issues that appear only once. For example, if the class were reading *Tom Sawyer*, a good topic might be "How did Tom feel about his community?" which appears throughout the book, as opposed to "What happened to Tom and Huck Finn when they ran away?" which a student could learn by reading only a section of the book. The expert topics may be put on ditto masters and one copy run off for each student, or they may be put on the chalkboard or poster paper.

3. Make a quiz for each unit. The quiz should consist of at least eight questions, two for each topic, or some multiple of four (e.g., 12, 16, 20), to make an equal number of questions for each topic. Teachers may wish to add two or more general questions to give the quiz an even number of items. The questions should require considerable understanding, because students will have had ample time to discuss their topics in depth, and easy questions would fail to challenge those who have done a good job in preparation. However, the questions should not be obscure. In the Blackfoot example, the first two questions might be as follows:

1A: Which of the following was not an expected way of behaving for a Blackfoot man?
   a. He was expected to be brave.
   b. He was expected to brag about how many of the enemy tribe he had touched.
   c. He was expected to clean buffalo meat.
   d. He was expected to share buffalo meat.

1B: What are norms of behavior?
   a. All the ways of acting that people in a group have
   b. The ways people in a group expect themselves and other members of the group to act
   c. Records of great deeds
   d. Sharing food with the very old

All students must answer all questions. The quiz should take no more than ten minutes. Teachers may wish to use an activity other than a quiz or in addition to a quiz as an opportunity for team members to show their learning—for example, an oral report, a written report, a crafts project.

4. Use discussion outlines (optional). A discussion outline for each topic can help guide the discussions in the expert groups. It should list the points that students should definitely consider in discussing their topics. For example, a discussion outline for a topic relating to the settlement of the English colonies in America might be as follows:

Topic: What role did religious ideals play in the establishment of settlement in America?

Discussion Outline

- Puritan beliefs and religious practices
- Puritan treatment of dissenters
- Founding of Connecticut and Rhode Island
- Quakers and the establishment of Pennsylvania
- Catholics and religious toleration in Maryland

Assigning Students to Teams. Assign students to four- or five-member heterogeneous teams exactly as in STAD.

Assigning Students to Expert Groups. You may wish to assign students to expert groups randomly, by simply distributing roles at random within each team. Alternatively, you may wish to decide in advance which students will go to each expert group, forming the expert groups to ensure that there are high, average, and low achievers in each. If your class has more than 24 students, you should have two expert groups on each topic, so that there will not be more than six students in each expert group. The reason for this is that an expert group larger than six can be unwieldy. Place team members' names on Team Summary Sheets, leaving the name blank.

Determining Initial Base Scores. Assign students initial base scores exactly as for STAD. Use a Quiz Score Sheet to record the initial base scores.

Schedule of Activities

Jigsaw II consists of a regular cycle of instructional activities as follows:

READING—Students receive expert topics and read assigned material to locate information.

EXPERT GROUP DISCUSSION—Students with the same expert topics meet to discuss them in expert groups.

TEAM REPORT—Experts return to their teams to teach their topics to their teammates.

TEST—Students take individual quizzes covering all topics.

TEAM RECOGNITION—Team scores are computed as in STAD.

These activities are described in detail in the following pages.

Reading

Time: ½-1 class period (or assign for homework)

Main Idea: Students receive expert topics and read assigned material to locate information on their topics.

Materials needed:
- An Expert Sheet for each student, consisting of four expert topics.
- A text or other reading assignment on which the expert topics for each student are based.

The first activity in Jigsaw II is distribution of texts and expert topics, assignment of topics to individual students, and then reading. Pass out Expert Sheets, and then assign students to take each topic (go to each team and point out students for each one). If any team has five members, have two students take Topic I together. Assignments to Expert Groups may be random or may be prepared in advance (if they are prepared in advance, try to make sure that each expert group has high, average, and low readers).

When students have their topics, let them read their materials. Alternatively, the reading may be assigned as homework. Students who finish reading before others can go back and make notes.

Expert Group Discussions

Time: One-half class period

Main Idea: Students with the same expert topics discuss them in groups.

Materials needed:
- Expert Sheet and texts for each student
- (Optional) Discussion outlines for each topic: one for each student with that topic.

Have all students with Expert Topic 1 get together at one table, all students with Expert Topic 2 at another, and so on. If any expert group has more than 6 students (that is, if the class has more than 24 students), split the expert group into two smaller groups. If students are to use a discussion outline, distribute it to them in each expert group.

Appoint a *discussion leader* for each group. The discussion leader need not be a particularly able student, and all students should have an opportunity to be discussion leader at some time. The leader's job is to moderate the discussion, calling on group members who raise their hands, and trying to see that everyone participates.

Give the expert groups about 20 minutes to discuss their topics. Students should try to locate information on their topics in their texts and share the information with the group. Group members should take notes on all points discussed.

While the expert groups are working, the teacher should circulate through the class, spending time with each group in turn. Teachers may wish to answer questions and resolve misunderstandings, but they should not try to take over leadership of the groups—that is the discussion leaders' responsibility. They may need to remind discussion leaders that part of the job is to see that everyone participates.

Team Report

Time: One-half class period

Main Idea: "Experts" return to their teams to teach their topics to their teammates.

Experts should return to their teams to teach their topics to their teammates. They should take about five minutes to review everything they have learned about their topics from their reading and their discussions in the expert groups.

If two students on any team shared Topic 1, they should make a joint presentation.

Emphasize to students that they have a responsibility to their teammates to be good teachers as well as good listeners. You may wish to have experts quiz their teammates after they make their team reports to see that they have learned the material and are ready for the quiz.

Test

Time: One-half class period

Main Idea: Students take quiz.

Materials needed:
- One copy of the quiz for each student.

Distribute the quizzes and give students adequate time for almost everyone to finish. Have students exchange quizzes with members of other teams for scoring, or collect the quizzes for teacher scoring. If students do the scoring, have the checkers put their names at the bottom of the quizzes they checked. After class, spot check several quizzes to be sure that the students did a good job of checking.

Team Recognition

Scoring for Jigsaw II is the same as for STAD, including base scores, improvement points, and team scoring procedures. Also as in STAD, certificates, newsletters, bulletin boards, and/or other rewards recognize high-scoring teams.

Original Jigsaw

Aronson's original Jigsaw resembles Jigsaw II in most respects, but it also has some important differences. In the original Jigsaw, students read individual sections entirely different from those read by their teammates. This has the benefit of making the experts possessors of unique information, and thus makes the teams value each member's contribution more highly. For example, in a unit on Chile, one student might have information on Chile's economy, another on its geography, a third on its history, etc. To know all about Chile, students must rely on their teammates. Original Jigsaw also takes less time than Jigsaw II; its readings are shorter, only a part of the total unit to be studied.

The most difficult part of original Jigsaw, and the reason that Jigsaw II is presented first in this manual, is that each individual section must be written so that it is comprehensible by itself. Existing materials cannot be used as in Jigsaw II; books can rarely be divided neatly into sections that make any sense without the other sections. For example, in a biography of Alexander Hamilton, the section describing his duel with Aaron Burr would assume that the reader knew who both men were (having read the rest of the biography). Preparing an original Jigsaw unit involves rewriting materials to fit the Jigsaw format. The added advantage of Jigsaw II is that all students read all the material, which may make unified concepts easier to understand.

Teachers who wish to use original Jigsaw to capitalize on its special feature of giving the experts unique information can use Jigsaw II with these modifications:

1. Write units that present unique information about a subject but make sense by themselves. This can be done by cutting apart texts and adding information as needed, or by writing completely new material.
2. Assign students to five- or six-member teams and make five topics for each unit.
3. Appoint team leaders, and emphasize team-

building exercises before and during use of the technique. See the section on "Teambuilding" later in this manual.

4. Use quizzes less frequently and do not use team scores, improvement scores, or newsletters. Simply give students individual grades.

For more information on original Jigsaw, see Aronson's *The Jigsaw Classroom* (1978).

Other Ways of Using Jigsaw

Jigsaw is one of the most flexible of the Student Team Learning methods. Several modifications can be made that keep the basic model but change the details of implementation.

1. Instead of having the topics refer to narrative materials given to students, have students search a set of classroom or library materials to find information on their topics.

2. Have students write essays or give oral reports instead of taking quizzes after completing the experts' reports.

3. Instead of having all teams study the same material, give each team a unique topic to learn together and each team member subtopics. The team could then prepare and make an oral presentation to the entire class. A method similar to this, Co-op Co-op, is described in detail below. Also see Sharan and Sharan (1976).

4. For other Jigsaw modifications, see Kagan (1985).

JIGSAW ACTIVITY

REFERENCE: Resnick, Lauren, Education and Learning to Think
National Academy Press, Washington, D.C., (1987)

THINKING IN THE CURRICULUM

How can we summarize the evidence reviewed in the preceding section, and what does it suggest to educators wishing to improve their students' thinking abilities? It is clear that if we were to demand solid empirical evidence supporting a particular approach to higher order skill development before implementing educational programs, we would be condemned at this time to inaction. There is far less empirical evidence of any kind available than we might have imagined and the evidence we have is often of limited utility. In most cases, the evidence amounts mainly to data showing that students who have taken particular courses are more likely to perform well on the tasks directly taught in the courses than students who have not taken those courses. Only a few studies have assessed the key

question of generalization to other parts of the school curriculum or out-of-school performance.

Although we cannot offer a "seal of approval" for any particular approach, the cumulative evidence justifies cautious optimism for the venture as a whole. Thinking and problem-solving programs within the academic disciplines seem to meet their internal goals and perhaps even boost performance more generally. It seems possible to raise reading competence by a variety of methods, ranging from study skill training through the reciprocal teaching methods of Brown and Palincsar to the discussions of philosophical texts in Lipman's program. On the other hand, general improvements in problem-solving, rhetoric, or other general thinking abilities have rarely been demonstrated, perhaps because few evaluators have included convincing assessments of these abilities in their studies.

Most programs reviewed here represent efforts to improve thinking skills through the addition of special courses or course units rather than through the modification of the mainline curriculum.* They thus offer a reasonable current estimate of how effective we can expect separate thinking and reasoning courses to be. As we have seen, although the available evidence does not establish that such courses can produce broad transfer of learning, neither does it allow us to strongly reject the separate course as an element in an educational reform program aimed at improving higher order abilities in students. Based on present evidence, general course effectiveness seems to depend on the extent to which it is accompanied by parallel efforts across the curriculum.

Embedding Thinking Skills in Academic Disciplines

In this view, prudent educational practice should seek to embed efforts to teach cognitive skills into one or another—preferably all—of the traditional school disciplines, and it should do this regardless of what may also be done in the way of special courses in thinking or learning skills. This discipline-embedded approach has several advantages. First, it provides a natural knowledge base and environment in which to practice and develop higher order skills. As we have shown earlier, cognitive research has established the very

*Some of the discipline-based problem-solving programs and some of the reading and self-monitoring programs represent important exceptions. The implications of these programs will be discussed further in subsequent sections.

important role of knowledge in reasoning and thinking. One cannot reason in the abstract; one must reason about something. Each school discipline provides extensive reasoning and problem-solving material by incorporating problem-solving or critical thinking training into the disciplines; the problem of "empty thinking"—thinking about nothing—is solved. As knowledge in the discipline develops, the base on which effective problem solving can operate is naturally available.

Second, embedding higher order skill training within school disciplines provides criteria for what constitutes good thinking and reasoning within the disciplinary tradition. Each discipline has characteristic ways of reasoning, and a complete higher order education would seek to expose students to all of these. Reasoning and problem solving in the physical sciences, for example, are shaped by particular combinations of inductive and deductive reasoning, by appeal to mathematical tests, and by an extensive body of agreed upon fact for which new theories must account. In the social sciences, good reasoning and problem solving are much more heavily influenced by traditions of rhetorical argument, of weighing alternatives, and of "building a case" for a proposed solution. Mathematics insists on formal proofs—a criterion absent in most other disciplines. Each style of reasoning (and several others that could be elaborated) is worth learning. However, only if higher order skills are taught within each discipline are they likely to be learned.

Finally, teaching higher order skills within the disciplines will ensure that something worthwhile will have been learned even if wide transfer proves unattainable. This point is profoundly important. It amounts to saying that no special, separate brief for teaching higher order skills need be made. Rather, it proposes that if a subject matter is worth teaching in school it is worth teaching at a high level—to everyone. A decision to pursue such an approach would transform the whole curriculum in fundamental ways. It would treat higher order skills development as the paramount goal of *all* schooling. Paradoxically, then, dropping the quest for general skills might, in the end, be the most powerful means of cultivating generally higher levels of cognitive functioning.

Saying that thinking skills should be incorporated into existing or planned disciplinary courses is by no means suggesting an easy path. We know less than we need to about how to do this job. Traditional formulations of the issue largely interfere with the kind of inventive educational thought and experimentation that will be needed to turn

classes in mathematics, history, physics, or English into arenas for teaching thinking and reasoning abilities. For example, the classic distinction between knowledge as something one reasons *about* and skills as something one reasons *with* has, in practice, placed process skills and knowledge in competition for limited instructional time. The idea that certain forms of knowledge can be powerful tools for learning and problem solving, or that processes and procedures are an expression of principled knowledge, is something that scholars and educators can agree on but have not really found ways to act on. (See Bransford, in press, for a particularly perspicacious analysis of this problem.) Instead, we have had reactive pendulum swings of attention either to process skills ("doing science," "doing history," etc.) or to building large bodies of knowledge. Research and experimentation focusing on how to truly combine these are badly needed.

Higher Order Approaches to the Enabling Disciplines

A particularly powerful way to begin transforming the school program is to concentrate on those parts of the traditional curriculum that enable learning and thinking in many fields. Reading is such an enabling discipline. So is writing, along with, perhaps, skills for effective oral communication. Mathematics is another candidate. Math is involved in many other disciplines, and skills of "mathematization," that is, the construction of formal representations and arguments, could be broadly enabling. The "3-Rs," then, come off rather well on this enabling criterion, although the reading, 'riting, and 'rithmetic curriculum called for in this higher order perspective will look quite different from the traditional hickory stick curriculum. Furthermore, it seems appropriate to add a "fourth R"—reasoning—to our list of potential enabling disciplines. Let us consider each of these briefly.

We have already discussed some current research that points to possibilities for changing the ways in which reading is taught. Thus far the research has shown mainly how very weak readers can be brought up to at least average performance levels. It is important to engage these students in meaning construction activities based on text in settings that incorporate modeling of good performance, lots of feedback, and opportunities to do small bits of the task in the context of seeing the whole job accomplished. However, we do not know for certain that these same methods are all that are needed to raise average performance levels to true high literacy levels. Finding

out what is needed to meet this goal is one important agenda for future research. Cognitive researchers about to embark on studies of this important topic would do well to examine the instruction in the high literacy academy tradition for strong hypotheses about the kinds of teaching likely to succeed.

The school curriculum has neglected writing for some time. Its potential role as a cultivator and an enabler of higher order thinking is very great, especially if we consider writing as an occasion to think through arguments and to master forms of reasoning and persuasion that are valued in various disciplines. Existing research clearly shows that children's—and perhaps many teachers'—conceptions of writing do not match what both skilled writers and cognitive research on writing tell us about the process. Children, and unskilled writers generally, tend to view composition as a matter of writing down what they know; Scardamalia and Bereiter (1985) call this the "knowledge telling" strategy of writing. Children are not aware of the role, or even of the existence, of the various discourse conventions and structures good writers use and readers expect (see Stein, 1986, for a review). Finally, they do not think of writing as a problem-solving process (cf. Flower and Hayes, 1980) in which plans must be made for communicating an organized point of view to an audience, and they do not understand that revision is integral to effective writing. Considerable research on the learning and teaching of writing is now underway, some of it focused on writing as a general tool for constructing and expressing arguments. Although the approaches being tried are extremely varied, most reflect a general point of view similar to the one underlying the successful approaches to teaching reading as a higher order skill. They treat writing as an *intentional* process, one in which the writer manages a variety of mental resources—linguistic knowledge, topical knowledge, knowledge of rhetorical forms, processes of attention and judgment—to construct a message that will have a desired impact on a reader. We now need research that focuses explicitly on cultivating and assessing these broad skills of meaning construction and interpretation. As in the case of reading, examination of traditional instruction in rhetoric and related fields should provide a profitable point of departure.

Mathematics must be discussed in somewhat different terms than reading and writing. It is not only an enabling skill, widely called on in a number of other disciplines, but also a discipline in its own right whose particular knowledge structures must be learned. Mathematics also poses special problems, derived from its heavy dependence

on formal notations. This has the effect of making it difficult for students to use their informal and intuitive knowledge of mathematical concepts to support school mathematics learning and to advance their mathematical competence. As we noted earlier, good evidence suggests that much school mathematics learning proceeds as a matter of memorizing rules for formal symbol manipulation without much understanding of why the rules work as they do or what the symbols stand for. If education were concerned only with the calculation skills needed to "get by" in routine jobs and family obligations, this would not cause much concern. But a high literacy approach to mathematics teaching cannot afford to let this separation between symbols and meaning, between calculation and mathematical reasoning, survive. Although many mathematics educators have sought ways of making particular concepts and procedures more understandable to children, to date no research has directly addressed the question of how a broad meaning-construction approach to mathematics learning can be promoted among all students—so that students themselves come to seek the connections between formal notations and their justifying concepts. This remains a major agenda for research leading to a higher order approach to mathematics teaching.

Reasoning has never had an explicit place in the mass education curriculum. Philosophy has no regular position in the standard American high school curriculum, nor is reasoning specified as part of the elementary school syllabus in the way reading, writing, and mathematics are. By contrast, both have been cornerstones of the elite, academy education tradition. Thus, incorporating reasoning into the regular educational program would extend the high literacy tradition to the entire school system. However, it is not clear whether reasoning should be treated as a separate discipline or suffused through the curriculum. Most philosophers working within the informal logic movement want to see critical thinking or reasoning courses included in the curriculum. Their argument is partly practical: reasoning skills will be passed over or trivialized if they are spread through the curriculum and not given formal recognition. But there is also a theoretical argument for treating reasoning as a separate enabling discipline; this is that principles of logical reasoning are unitary, not specific to particular domains of knowledge (see Paul, in press, responding to a contrary argument by McPeck, 1981). Currently, we have no empirical evidence to support the idea that teaching people to recognize and analyze reasoning fallacies—a core element in most critical thinking and informal logic curricula—in fact leads them to

avoid such fallacies in their own thinking. Without careful attention to this problem, informal logic could become just another body of knowledge—perhaps judged valuable in its own right but without claim to a special role in the general development of higher order thinking and learning capabilities. We need, then, substantial new research, requiring the collaboration of philosophers and cognitive scientists, to identify approaches to teaching reasoning that actually improve reasoning performance either in academic disciplines or in practical situations.

CULTIVATING THE DISPOSITION TO HIGHER ORDER THINKING

It has been convenient to examine teaching programs in several distinct categories. Yet there are striking points of similarity among those programs that have shown some promising results. Many such programs rely on a social setting and social interaction for much of teaching and practice. Although one can imagine individually worked exercises designed to improve aspects of thinking skill, very few programs in fact propose such activities. Instead, students are encouraged to work problems in pairs or in small groups. Instructors may also orchestrate special discussion and practice sessions. When investigators of different theoretical orientations and disciplinary backgrounds converge on a common prescription in this way, we should consider what shared intuition may be at work. What roles might social interaction be playing in the development of thinking? The authors cited in the preceding pages mention several possibilities.

First, the social setting provides occasions for *modeling* effective thinking strategies. Skilled thinkers (often the instructor but sometimes more advanced fellow students) can demonstrate desirable ways of attacking problems, analyzing texts, and constructing arguments. This process opens normally hidden mental activities to inspection. Through observing others, students can become aware of mental processes that might otherwise have remained entirely implicit. Research suggests, however, that modeling alone does not produce very powerful results. If students only watched more skilled thinkers perform, they would not substantially improve their own thinking.

Apparently there is more to learning in a social setting than watching others perform. "Thinking aloud" in a social setting allows

others—peers or an instructor—to critique and shape one's performance, something that cannot be done effectively if only the results but not the processes of thought are visible. The social setting may also provide a kind of scaffolding for an individual learner's initially limited performance. Instead of practicing small bits of thinking in isolation with no sense of each bit's significance to the task as a whole, a group solves a problem, or writes a composition, or analyzes an argument together. Within the group, extreme novices can participate in performing complex tasks. If things go well, they can eventually take over most or all of the work themselves, with a developed appreciation of how individual elements in the process contribute to the whole. This theory, adapted from Vygotsky (1978), is embodied explicitly in the reciprocal teaching of Palincsar and Brown, and variants of it have been proposed by a number of other investigators (e.g., Collins et al., in press).

The social setting may also function to motivate students. Students are encouraged to try new, more active approaches, and they receive social support even for partially successful efforts. Through this process, students come to think of themselves as capable of engaging in independent thinking and of exercising control over their learning processes. The public setting also lends social status and validation to what can perhaps best be called the *disposition* to higher order thinking. The term disposition should not be taken to imply a biological or inherited trait. As used here, it is more akin to a *habit* of thought, one that can be learned and, therefore, taught. Engaging in higher order thinking with others seems likely to teach students that they have the ability, the permission, and even the obligation to engage in a kind of critical analysis that does not always accept problem formulations as presented or that may challenge an accepted position.

We have good reason to believe that shaping this disposition to critical thought is central to developing higher order cognitive abilities in students. Research on strategy training shows that, if instruction is to work at all, it often works very quickly—in just a few lessons or sometimes with little more than directions to use some strategy. However, people induced to use a particular learning strategy will often do so on the immediate occasion but will fail to apply the same strategy on subsequent occasions. Both of these recurrent findings serve to remind us that much of learning to be a good thinker is learning to recognize and even search for opportunities to apply one's mental capacities (cf. Belmont et al., 1982).

This suggests that the task for those who would raise the intellectual performance levels in children is not just to teach children new cognitive processes but to get them to use those processes widely and frequently. The kind of higher order thinking we have discussed requires elaborating, adding complexity, and going beyond the given to construct new formulations of issues. It also involves weighing multiple alternatives and sometimes accepting uncertainty. As such, higher order thinking requires effort on the part of the individual and may involve some social risk—of disagreeing with others perceived to be more powerful, of not arriving at the expected answers, of not always responding instantly. To overcome these difficulties, educational institutions must cultivate not only skills for thinking but also the disposition to use them.

A widely shared set of implicit assumptions exists about how dispositions for higher order thinking might develop. They center on the role of a social community in establishing norms of behavior, providing opportunity for practice, and providing occasions for learning particular skills. The fundamental theme is that such dispositions are cultivated by participation in social communities that value thinking and independent judgment. Such communities communicate these values by making available many occasions for such activity and responding encouragingly to expressions of questioning and judgment. The process of learning is further aided when there are many opportunities to observe others engaging in such thinking activities. Finally, dispositions for higher order thinking require sustained long-term cultivation; they do not emerge from short-term, quick-fix interventions.

This set of beliefs, although highly plausible, has received little empirical investigation. On the whole, research on the development of cognitive abilities has proceeded quite separately from research on social and personality development. For example, the extensive body of childhood socialization research (Hetherington, 1983) says much about the emergence of traits such as aggressiveness, dependency, conformity, or gender identification, but it says little about how intellectual tendencies develop. An interesting new research project (Caplan, 1985) on the development of intellectual curiosity in young children appears to be a first link between research on child socialization and our present concern for shaping higher order thinking dispositions.

"Cognitive styles" (e.g., Messick, 1976) such as reflectivity are known to be related to school performance, and efforts have been

made to shape reflectivity (e.g., Meichenbaum, 1985). But this research has not generally attended to the qualitative aspects of intellectual performance, and it is impossible to know whether higher order thinking was in fact improved. Other research on improving persistence (e.g., Turkewitz et al., 1975) has tended to measure how much work students do but not whether they engage in complex cognitive activities. Some recent research on intrinsic motivation may help tie motivation to the quality as well as the quantity of educational work (see Lepper, 1981, 1983; Nicholls, 1983). When people work to gain praise, grades, or material benefits, they are externally motivated. When they work to master a task, they are intrinsically motivated. Apparently some correlation exists between the kinds of motivations that keep people working and several qualitative features of their work: for example, the complexity of the tasks they choose to work on, the range of material to which they attend, and the extent to which they are able to shift direction ("break set") to pursue a new, more fruitful approach (Condry and Chambers, 1981; Kruglanski, 1981; Lepper and Greene, 1981; McGraw, 1981).

A promising link between quality of thinking and persistence is being forged by investigators studying differences in people's conceptions of ability. For example, Dweck and her colleagues (Dweck, in press; Dweck and Elliot, 1983) have shown that individuals differ fundamentally in their conceptions of intelligence and that these conceptions mediate very different ways of attacking problems. A distinction is made between two competing conceptions of ability, or "theories of intelligence," that people may hold. One, called the *entity* conception, treats ability as a global, stable quality. The second, called the *incremental* conception, treats ability as a repertoire of skills that can be expanded through efforts to learn. Entity conceptions orient children toward *performing* well so that they can display their intelligence and toward not revealing lack of ability by giving "wrong" responses. Incremental conceptions orient children toward *learning* well so that they can acquire new knowledge or skill. Most relevant to the present argument, incremental conceptions of ability and associated learning goals lead children to analyze tasks and to formulate strategies for overcoming difficulties. We can easily recognize these as close cousins to the kinds of higher order thinking discussed in this essay. In a related analysis, Covington (1983) suggests that people who view ability as created through strategic

self-management (of study time, of types of elaboration, of ways of attacking tasks) will be better able to compensate for self-attributions of low initial ability.

A key question, of course, is whether these differences in type of motivation or theory of intelligence can be deliberately shaped by the way in which school activity is organized. Evidence suggests that the nature of the environment in which one works makes a difference in whether one invokes internal or external motivations for one's work. However, research has not examined whether personal traits favoring internal motivation can be developed by deliberately altering institutional or social patterns. Very recent work by Dweck and her colleagues is examining ways of helping students to acquire and apply incremental conceptions of intelligence, but more extensive research is required before clear conclusions can be drawn. In any case, these lines of motivation research highlight the possibilities for an important convergence between efforts aimed at teaching higher order cognitive skills and those aimed at cultivating dispositions to apply those skills.

NOTES

Brainstorming

"Brainstorming" is the name we give to a method that can be used by a group of people to think up lots of new ideas, the first step in solving a problem.

Brainstorming should be fun. . . the group should be informal and relaxed. Because problems do not usually have only one right answer, everybody's ideas are valuable. Nobody will be "right" or "wrong."

Every idea will be listened to in a Brainstorming group. We all know that sometimes, people are afraid to share an idea with others, because they fear that other people may think it's "dumb" or "silly." These words are never heard in a Brainstorming group. In Brainstorming, we want to share every idea we have with the other members of the group, and no one is allowed to criticize.

There are a few, very simple "ground rules" for Brainstorming:

1. Do not criticize your own ideas or those of anyone else.

2. Be a "free-wheeler." The wilder you idea, the better. Never be afraid to give any idea to the group, it's easier to "tame down" ideas later on than it is to think up new ones.

3. Think of as many ideas as you can. The more ideas your group can get, the better the chances that plenty of really good ideas will be found. Don't put on the brakes. . . try to get lots and lots of new ideas.

4. Be a hitch-hiker! Sometimes, another person's idea will give you a good new idea. Don't let it get away! (Piggy-backing)

5. Try to combine ideas. Look for ways to combine two or more ideas into a new one. You might combine your own ideas, or one of yours with some from other people, or the ideas of two or more other people. Make as many combinations as you can.

MD/dal
7/89

TRANSPARENCIES

OBJECTIVES

HIGHER ORDER THINKING:

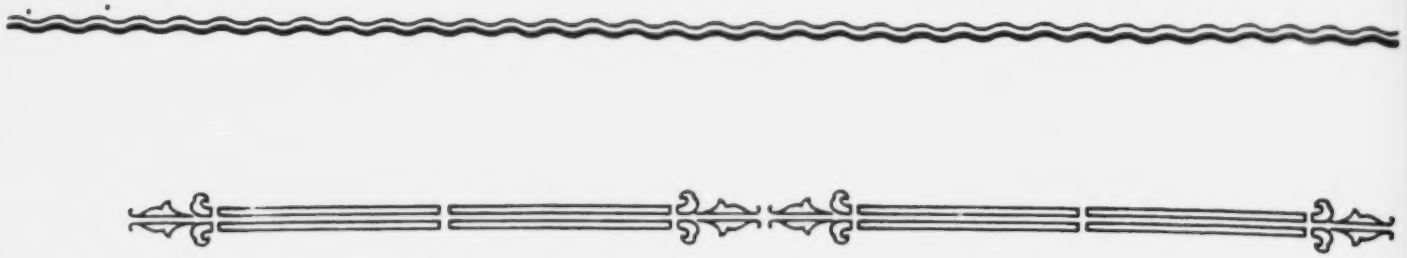
INCREASING STUDENT INTERACATION IN THE "THOUGHTFUL" CLASSROOM

By the conclusion of this workshop, participants will be able to:

- distinguish between overt and covert participation and give examples of each
- identify strategies for encouraging students to assume responsibility for speaking in the classroom
- implement methods which promote student interaction: human treasure hunt, group problem solving, pair problem solving, brainstorming, jigsaw
- describe and list activities for promoting student metacognition

BENEFITS OF ACTIVE PARTICIPATION

- Increases students' rate of learning
- Improves student retention of information
- Holds students' attention
- Fosters student accountability
- Assists teacher to assess learning



"Tell me, I forget.

Show me, I remember.

Involve me, I understand."

Ancient Chinese Proverb

BECAUSE

"I don't have my homework done today because..."

RULES OF THE CLASSROOM GAME

Teacher/Structure	**(T/Str)**
Teacher/Solicitation (Question)	**(T/Sol)**
Pupil/Response	**(P/Res)**
Teacher/Reaction	**(T/Rea)**

Bellack

Language of the Classroom

TYPICAL TEACHER/PUPIL INTERACTION

5:1

PD:me
2/87

NATURE OF STUDENT PARTICIPATION

1. BRIEF

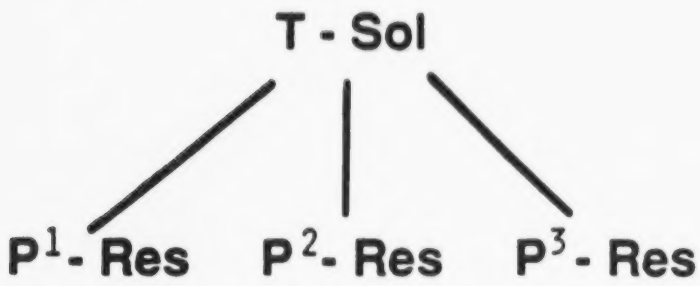
2. FRAGMENTED

3. LOW IN COGNITION (BLOOM)

4. DECLARATIVE

Bellack

INTERACTION MODELS



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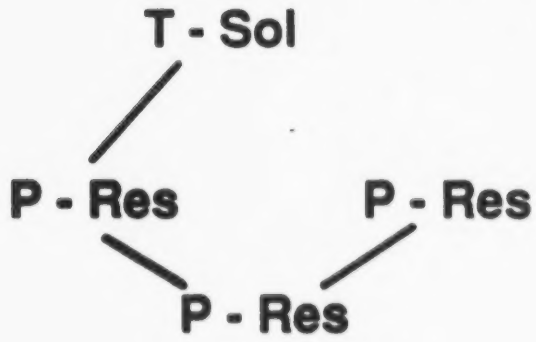

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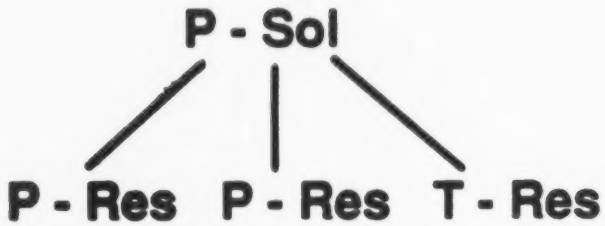

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"RESPONDING"

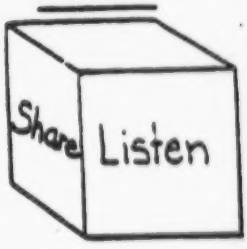
"There is no such thing as a wrong answer. However, if there were such a thing, that certainly would have been it."

BEST COPY AVAILABLE

Hand Signals

Listen Think Pair Share

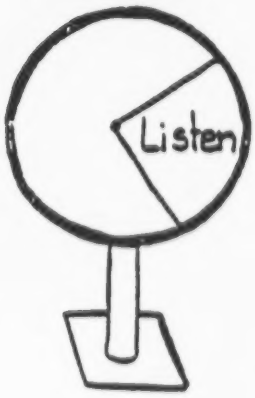
Cube



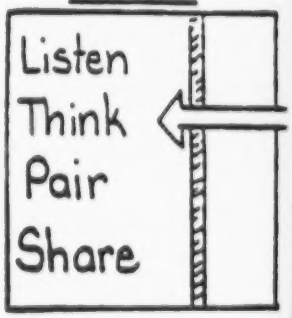
Cues for

Listen · Think · Pair · Share

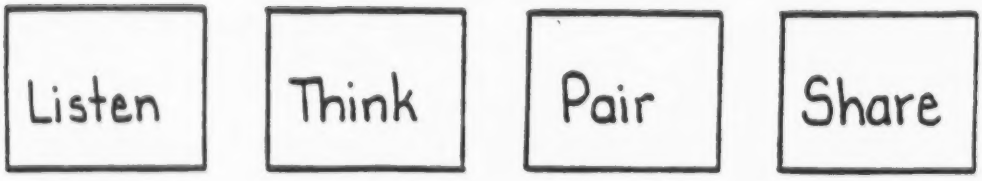
Wheel



Chart



Cards



"Throw One Out"

COW
HORSE
BED
CHICKEN

PENCIL
WHISPER
TALK
YELL

PD:bj
07/89

PAIR PROBLEM SOLVING

"A friend is one before whom I can think aloud."

Ralph Waldo Emerson

~~~~~~~~~~~~~~~~~~~~~~~~~~~~

The Listener Should:

1. Check for accuracy
2. Point out errors but don't correct
3. Demand constant vocalization
4. Pause & clarify but don't interrupt
5. Encourage persistence

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07/89
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METACOGNITION

1. Strategy planning
2. Question generating
3. Conscious choice
4. Differentiated evaluation
5. Take credit
6. Outlaw "I can't"
7. Paraphrase or reflect back to student ideas
8. Label student behavior
9. Clarify student terminology
10. Role playing and simulations
11. Journals
12. Modeling

JIGSAW

- Cooperative learning strategy
  - Extensive reading/short time
  - Encourages active participation
  - Promotes student interaction/social skills
  - Enhances learning
- Process
  - Initial groups share a reading, discuss, become "experts" with information
  - Second groups-members from each previous group; teach each other information from readings
  - Each participant responsible for information from all readings

BRAINSTORMING

WHY?

- TO GENERATE A LARGE NUMBER OF IDEAS
- TO OPEN PEOPLE UP TO SHARING IDEAS WITHOUT FEAR OF CRITICISM
- TO ENABLE PEOPLE TO BUILD ON EACH OTHERS' IDEAS

REMEMBER:

- QUANTITY IS DESIRED
- FREE-WHEELING IS WELCOMED
- ALL RESPONSES ARE ACCEPTED - NO CRITICISM
- HITCH-HIKING (OR PIGGYBACKING) IS ENCOURAGED

FORCED ASSOCIATION

Thinking is like candy because. . .